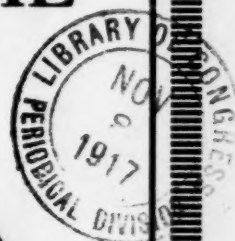


THE JOURNAL

OF THE



Vol. II

OCTOBER, 1917

No. 2

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HERETOFORE the *Journal of the American Association of Cereal Chemists* has been distributed gratis. The members decided at the last meeting to continue this practice, but in view of the limited number of members and the wide circulation that has been found desirable, it was deemed expedient to establish what shall be known as a sustaining membership.

The fee for membership will be ten dollars per year and a list of the names of the firms and persons that become associated with our organization in this manner will be published in each issue of the *Journal*.

It is hoped that milling firms and others interested in promoting investigations of a nature to aid the cereal industries will take advantage of this means to show their interest.

Address

L. R. OLSEN,
Care Eagle Roller Mills,
New Ulm, Minn.

OCT 20 1917

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THE JOURNAL

of the

AMERICAN ASSOCIATION

of

CEREAL CHEMISTS

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Opening Address by President Weaver

Kansas City Meeting, May 24, 1917

Gentlemen: At this time it seems fitting to me that we should pause and once more consider the purpose of our organization, what we have already accomplished and how best to obtain results in the future. The Association is now two years old. Its purpose, according to our constitution, is "to reach, by means of research, and discussion, agreement in the methods of analysis necessary in the cereal laboratory."

That such an organization with such a purpose was needed, is shown by the rapid growth of the society and by the loyalty of the members. There have been no resignations caused by the non-payment of dues, and the membership has been quadrupled in the two years that it has been organized. We have members now from all parts of the United States, Canada, England and Scotland. All of the members have shown a willingness to work together, ten have contributed articles for the JOURNAL, and in some cases several contributions have been made. In view of the number of members that have been elected to membership recently, this is a very creditable showing.

What have we accomplished? (1) We have provided a much needed organization for cereal chemists, and (2) we have agreed upon methods for the determination of moisture, ash, protein in flour, protein in wheat, and a uniform method of reporting loaf volume. This may seem very meager as the result of two years work, but it must be remembered that we have been growing very rapidly. Every new member brings new ideas, all of which are worthy of consideration. Under such conditions progress is necessarily slow, but from the ideas and experience of many instead of a few, we shall in the end be able to obtain better and broader methods.

Now let us consider our needs; first, we are badly in need of a uniform baking test. There are many things to be considered in the adoption of a method, and there will probably be much more work and discussion before an agreement can be reached as to the manner in which this test should be carried out. The baking test is the final and check test of all the other work done in the laboratory. Its importance is great and it is therefore wise to proceed slowly and carefully

before making any method official. Secondly, there is an urgent need of a more accurate means of determining the color of flour. As the matter now stands, all that is recorded on the report concerning the color of a sample is the *opinion* of the chemist. Other conditions demanding our attention are the varying methods in use for the determination of Acidity, Soluble Proteins, Reducing Sugars, and Soluble Extract. I am pleased to note that all of these things are receiving the attention of our members and I am hopeful that good, workable methods will be available in a short time. Lastly, and what I feel to be the great and crying need is for more *research*. I feel that our knowledge of cereal chemistry is as yet very limited. I have often felt, and no doubt many of you have also, that the reports on wheat and flour were but half told tales, and that there was much useful information still to be gained if we but knew what to look for and how to get it. There is a large field for the research worker; every member should devote at least a part of his time to original investigation. Many of our number have made serious efforts along new lines, but I find a reluctance on their part to tell of their results, seemingly because of a feeling that because they have not made a great discovery they have not accomplished anything worth mentioning. This attitude is entirely wrong. The advancement of cereal chemistry will come about by the accumulated efforts of all rather than by the efforts of a single great genius. We should give careful and thoughtful attention to all suggestions from others and especially should we diligently strive to perfect the proposed methods. We must prove to the satisfaction of all that a method is good, and suited to our requirements before adopting it. We cannot proceed too carefully in selecting methods. We cannot test them too thoroughly, and in this

particular let us "make haste slowly."

The little that we have been able to accomplish has brought us some criticism, but criticism is always the result of progress. Most of such criticism has been caused by our stand in regard to "protein." Many good articles have been called forth by that resolution, and I believe that the difference between "protein" and "gluten" is at last thoroughly understood. There are still some chemists that prefer the gluten test to the protein test and labeling the result "gluten" is, insofar as I can learn, practiced by only one laboratory.

The gluten test may be used at intervals with good results. For instance, if I had a sample of wheat that I suspected of being frosted, I would probably wash some gluten from it. I am very glad, however, that this Association is rapidly discontinuing the gluten test as a part of the routine work. The sooner we stop trying to explain things by the gluten test, and attempt to learn what is really causing the trouble, the sooner we will make some progress.

Gentlemen, in closing, let me say, that we have made a good start as an Association, although we have made mistakes and probably will make others. The main thing to do is to go forward. Let us all return to our laboratories after this meeting with the determination to work harder than ever before, for the advancement of our splendid science.

Minutes of Meeting of the American Association of Cereal Chemists

Kansas City, Mo. Coates House
May 24, 25, 26, 1917

President Weaver addressed the members present, giving a resume of what the Association has accomplished and an outline of the work before it.

Following his address, Mr. Weaver read interesting letters from Prof. Wm.

Jago, of England, and Mr. J. C. Clark, of Scotland.

The correspondence between Prof. Summers and Mr. Schollenberger relative to the misuse of the latter's notes was read. A discussion followed and a committee was appointed to investigate and report their findings before the close of the last session.

Mr. C. F. Buck was appointed Foreign Secretary, his duties being to keep directly in touch with our foreign members.

Adjournment.

Immediately after lunch the members spent an hour at the Trans-Mississippi Master Bakers' Convention at Convention Hall.

2:00 P. M., MAY 24

The following papers were read:

"What is the function of a cereal chemist?"

By GORDON AULD (*Wells-Abbott-Nieman Co.*), *Schuyler, Nebr.*

"Investigations of the Gasoline Color Value of Flour."

By C. F. BUCK (*Hoffman Mills*), *Enterprise, Kansas.*

"The Milling and Baking Qualities of Texas Wheat."

By EARL F. OLMSTEAD (*Ft. Worth Laboratories*), *Ft. Worth, Texas.*

"Ash Determinations."

By W. A. GOLDTRAP (*Larabee Flour Mills Corp.*), *Clinton, Mo.*

Adjournment.

9:00 A. M., MAY 25

The Treasurer's report, showing a balance on hand of \$79.68, was read and accepted.

The Executive Committee reported the acceptance for membership of the following applications:

L. D. JACKSON (*Western Canada Flour Mills Co.*), *Winnipeg, Man.*

S. J. LAWELLIN (*Southwestern Milling Co.*), *Kansas City, Mo.*

C. F. TRONSEN (*Royal Milling Co.*), *Great Falls, Mont.*

PROF. WM. JAGO (*Cereal Chemist*), *Hove, Sussex, England.*

The report was accepted.

The election of officers followed. Those elected were:

President, C. J. PATTERSON.

V.-Pres.-Bus. Mgr., C. F. BUCK.

Sec'y-Treas., L. R. OLSEN.

Ch. Ex. Com., H. E. WEAVER.

Editor of Journal, R. WALLACE MITCHELL.

The Executive Committee appointed consists of the following members:

H. E. WEAVER, *Chairman.*

S. J. LAWELLIN.

A. W. ESTABROOK.

A. H. PORTER.

It was voted to have a group picture taken at the close of the morning session.

It was moved and carried that we elect secretaries in foreign countries where we have members, who are to cooperate with our Foreign Secretary, Mr. C. F. Buck.

Mr. L. D. Jackson was elected Canadian Secretary and Mr. J. C. Clark was elected British Secretary.

The Secretary was instructed to write to Mr. Clark asking him to cooperate with Mr. Buck.

A discussion on financing our JOURNAL followed. It was moved and carried that a milling firm membership of \$10 per year be established, and a list of supporters be published regularly in the JOURNAL.

Adjourned to have picture taken.

2:00 P. M., MAY 25

The members present were taken in automobiles to the plants of the Southwestern Milling Co. and Ismert-Hincke Milling Co. Upon arriving they were shown through mills and laboratories.

6:00 P. M., MAY 25

Association banquet at the Coates House.

9:00 A. M., MAY 26

President Patterson read one set of circular letters which had traveled among the members.

The following papers were read:

"Baking Test in Our Laboratory."

By B. H. KEPNER (*Maple Leaf Milling Co.*), *Port Colbourne, Ont.*
(Mr. Kepner was unable to be present and the paper was read by Mr. Mitchell.)

"Protein, the Part It Plays in the Flour Milling Industry."

By C. J. PATTERSON (*Ismert-Hincke Milling Co.*), *Kansas City, Mo.*

"Investigations Into the Methods of Determinating Soluble Protein, Reducing Sugars, Acidity, and Soluble Extracts."

By H. E. WEAVER (*The Larabee Flour Mills Corp.*), *Hutchinson, Kansas.*

"Comparison of the Long and Short Fermentation Methods for Laboratory Baking."

By R. WALLACE MITCHELL (*Kansas Milling Co.*), *Wichita, Kansas.*

"Gliadin."

By L. R. OLSEN (*Eagle Roller Mills*), *New Ulm, Minnesota.*

Adjournment.

2:00 P. M., MAY 26

It was moved and carried that two members from the same city be appointed to write articles in defense of pure white wheat flour and have them published in the newspapers. It was moved and carried that the President be the chairman of this committee. It was moved and carried that the articles submitted for publication be signed by the Association name. The President appointed Mr. Lawellin as the second member of this committee.

Mr. Sasse, as chairman of the committee appointed to investigate the Summers-Schollenberger affair, reported having interviewed Mr. Schol-

lenberger. Mr. Sasse had with him several copies of the *Operative Miller*, together with Mr. Schollenberger's notes and these were passed around among the members present for comparison. After a discussion of the facts of the case, it was moved and carried that the Secretary write to Mr. Summers asking him to apologize to Mr. Schollenberger (in a manner satisfactory to Mr. Schollenberger) for the misuse of his notes. It was further moved and carried that if the apology is not forthcoming that the Secretary ask Mr. Summers to withdraw his membership from the Association. It was the unanimous opinion of the members present that Mr. Summers was guilty of plagiarism.

After considerable discussion, it was moved and seconded that we report determinations on flour (such as ash, protein, etc.) on a 13.5 per cent moisture basis. Also that the moisture be reported on the sample as received.

It was moved and carried that the President, Secretary, and Editor constitute a committee to see to it that articles of value concerning Cereal Chemistry are published.

It was moved and carried that Mr. Barstow be appointed to see that each member contribute some article for our next meeting.

It was moved and carried that we accept the report blanks as drawn up by the committee on same with several changes and the addition of six blank lines.

It was moved and carried that the President appoint a committee (with the consent of appointees) to collaborate on Mr. Weaver's methods for determination of Soluble Proteins, Soluble Extract, Acidity and Reducing Sugars. The following were appointed: Messrs. Mitchell, Buck, Schulz, and Seeber.

It was moved and carried that the President appoint a committee to study baking formulae and methods

and report their findings at the next meeting. The following were appointed: Messrs. Jackson, Olmstead, Ackers, Barstow, and Hogan.

It was moved and carried that the "Round-robin" letters be continued and started by the same committee.

It was moved and carried that the Association express its appreciation to the Coates House for their cordial service.

It was moved and carried that the Association express its appreciation to the management of the Southwestern Milling Co. and the Ismert-Hincke Milling Co. for their kindness in placing automobiles at our disposal and showing our members through their milling plants.

Adjournment.

Members present were:

Frank Ackers	L. R. Olsen
C. F. Buck	A. R. Sasse
J. M. Hogan	H. F. Vaupel
Willis N. Kelly	H. E. Barstow
F. H. Loomis	W. A. Goldtrap
E. J. Olmstead	A. A. Jones
F. D. Patterson	L. E. Leatherock
Clarence Seeber	R. W. Mitchell
Gordon Auld	C. J. Patterson
A. W. Estabrook	M. E. Schulz
L. D. Jackson	H. E. Weaver
S. J. Lawellin	J. C. Wood
R. A. Lusk	

Signed, L. R. OLSEN,
Secretary-Treasurer.

Notes about Members

M. E. Schulz has resigned from his position with the George P. Plant Co., of St. Louis. He entered the medical corps of the army and is "Somewhere in France."

C. R. Southwell has left the employ of the Wichita Flour Mills Co., and is now with the Guthrie Mill & Elev. Co., of Guthrie, Okla.

R. A. Potts has returned to Wichita from Dallas, Texas, where has been with the Stanard-Tilton Milling Co. for the past eighteen months. He

is now with the Wichita Flour Mills Co.

At last report C. F. Buck was still with the George P. Plant Co., but expects to return to Enterprise, Kans. as soon as he can get some one to fill his place.

S. J. Lawellin is now located with the Canadian Mill & Elev. Co., at El Reno, Okla.

A. R. Sasse has been in business with Mr. Pandermaly since May first. They have a milling and baking laboratory in Kansas City, Mo.

Abstracts

The utilization of amonium chloride by yeast, by Chas. H. Hoffman, Jr. *Ind. & Eng. Chem.*, Feb., 1917. A paper showing the advantage of using amonium chloride as a source of nitrogenous food for the yeast plant.

Nitrogen in amino forms as determined by fomol titration, in relation to some factors measuring "quality" in wheat flour, by C. O. Swanson and E. L. Tague, Jr. *Am. Chem. Soc.*, March, 1917. Authors conclude that nitrogen in the amino form, together with the ash and acidity is of value in measuring the quality of wheat flour.

The Technic of American Milling, by Ernest Reiner, *Northwestern Miller*, May 16, 1917. Mr. Reiner discusses wheat cleaning and blending, and considers in detail the gluten test as carried out in Europe.

The Proteins of Wheat and Corn, N. W. Miller, May 30, 1917.

Milling and Baking Experts in Session, *Bakers Weekly*, Jan. 6, 1917. An abstract covering the annual meeting of the A. S. M. B. T., held at Washington, D. C., Nov. 22, 1917.

"A Comparison of Several Classes of American Wheat and a Consideration of Some Factors Influencing Quality," by L. M. Thomas, U. S.

Dept. of Agr. *Bul. No. 557*. Flour strength defined. Influence of protein content on strength. Quality affected by test weight and soundness. Weight of 1000 kernels not indicative of quality, yield, etc.

"Characteristics and Quality of Montana Grown Wheats," by L. M. Thomas, U. S. Dept. of Agr. *Bul. No. 552*. Montana grown wheat considered and compared with Kansas and Minnesota types in respect to quality, yield, color, texture, etc.

"Enzymes in the Fermentation Industry," by Leo Wallerstein, Jr. *Franklin Inst.*, May and June 1917.

The Function of a Cereal Chemist

No business is prone to increase its investments and expenditures without first seeing an opportunity for profit or some benefit to be realized therefrom.

In this respect, the milling industry is no exception. No new expenses are introduced, unless by so doing, some desirable result is obtained.

Before the miller included the cereal chemist in his organization he first satisfied himself that the cereal chemist could perform a desirable function. Now what is this function? It behooves us to consider this point.

Since it is the business of a miller to make flour, he naturally expects the chemist to assist and since each mill has its particular class of trade, it becomes a duty of the cereal chemist to assist to make as much flour—as good flour—as cheaply as possible. Moreover this flour must conform to the requirements of the mill's trade.

One mill caters to the bakery trade; another to the household trade; and still another to the biscuit and cracker trade. With some mills superb quality is sought for; in others, just a good quality.

Each presents different problems and requires different methods of

solution. Such methods are within the scope of the cereal chemist.

As has been stated, the function of the chemist is to assist the miller to make as much flour, as good flour as cheaply as possible. Then let us see in what way he can assist:

To give the greatest satisfaction a flour must run uniform day in and day out. To accomplish this result a uniform wheat mixture is required. Wheat being the basis of flour, it follows that to make good flour, good wheat must be used. To the miller who is obliged to gather his stock from scattered sources, it is a problem to know what wheat will give the desired results, and how to blend them to get these results.

Here is where the chemist can be of the greatest help. With the assistance of an experimental mill, each sample can be speedily milled and tested, and its quality and adaptability determined.

These results should determine the classifying and binning of the wheat so that the milling mixture will run uniform and produce a flour of the character desired.

At times it is more economical to mill some wheat from uncustomary sources. Crop conditions, freight rates and other economic factors often times render this condition possible. A red winter wheat miller may desire to use some white wheat or a hard winter wheat miller to use some spring. There are times when many such combinations would be advantageous.

A careful analysis of these various wheats probably will disclose a blend that will make as good and possibly a better flour than originally, and make it cheaper.

Though the selection of wheat is probably the most important duty of the chemist, it is also important that he keep a careful check upon the milling processes to insure their proper functioning.

Oftentimes, the break rolls may be

set too closely, or the purifiers may be working improperly, and the color or the general appearance of a flour will suffer as a consequence. These variations can be speedily detected and remedied by making regular checks on the flour.

It is obvious then that the methods of analysis employed by the chemist should give immediate, reliable, and adequate information, upon which to base conclusions as to the procedure to follow to meet existing conditions.

Sometimes I wonder if, when working out our methods, we carefully consider what the results will accomplish. Will a knowledge of these results assist us to make more flour, better flour, and make it more cheaply? If the results are not adapted to constructive thought, then are the methods that produce these results, worthy of our consideration?

After reading our round-robin letter, and noting the differences in opinion as to our methods, I wonder if we have a common measure with which to gauge the merits of a method. If we have not, we should have, or else we will be like a ship without a port—just drifting.

Every method should be made to stand on its record. Will it assist the chemist to fulfill his function?

GORDON AULD.

Protein and Its Value to the Flour Milling Industry

The title of my paper may seem a bit far fetched to some. But if the title were put to me in the form of a question, I would unhesitatingly answer, "Protein is the Back Bone of the Flour Milling Industry." I mean this only in connection with the quality of the product produced.

We well know protein to be that constituent of flour which gives quality to the flour from a baking standpoint.

On each new crop we are very anxious to obtain a sample of wheat

to determine the baking value for the coming year. So it is the protein of the wheat more than any other one constituent, or condition of the wheat that interests us most. Protein is used in place of gluten because in protein we have all the nitrogen producing constituents of the flour, and the water soluble proteins are shown in recent research to have some bearings on the quality of the flour. These water soluble proteins would be discarded in gluten washing.

Protein to the progressive miller is of prime importance. For he must have protein of good quality, and if given this, the modern miller can produce a flour of high quality and uniformity.

In several places the word quality has been used. We know that flour having a protein of good quality will make a fine well piled loaf, and one of poor quality, no loaf. But what is quality of protein from a chemical standpoint. The old saying, "If a little will do good, more will do better," certainly does not apply here, as quantity has little value as compared with quality.

The Gliadin-Glutelin ratio has been confirmed by some well known authors and disputed by others. I, for one, do not believe the Gliadin-Glutelin ratio to be a controlling factor for quality. But I do believe the quality of the protein in flour will be worked out and determined by some chemical process. Whether it will be the true chemical and physical composition of the protein as it naturally exists in the berry, or whether it will be the behavior of the protein during the process of fermentation is a question.

Again the quality may be there with some enzyme, bacteria, organic acid, or other organic substance present which has a retarding action on the process of fermentation. This has been stated by some investigators to be true, giving phytic acid, as the organic acid present, along with certain enzymes.

Some references are given here on a very small part of the research work being carried on along the line of wheat protein. This is not meant to be a summary of the work, but to give an idea of the nature of the work.

Blish (*1) has given a very convincing work on the Gliadin-Glutenin ratio. And in his summary states that there is little value to the ratio for controlling the quality.

H. Jessen Hansen (*2) claims the quality of flour can be determined by obtaining the hydrogen ion concentration, and says that some flour improvers are of an advantage, because they do increase the hydrogen ion concentration. There is a question as to the adaptability of the method for control work.

Snyder's (*3) work on soluble proteins in flour is of interest. Snyder says the soluble proteins can be extracted, leaving gliadin and glutenin without decreasing the expanding power of the flour.

On this same subject Bremer (*4) claims the soluble protein have no bearing on the strength of flour.

Again Rousseaux & Sirot (*5) state that there is a great value in the ratio between total nitrogen and soluble nitrogen.

In totaling the literature on flour protein we will find a varying result. This need not lend a discouraging atmosphere toward the present research on flour, as in every line of chemistry will be found similar conditions. And the increasing number of chemists taking up research on flour will no doubt give some interesting results in the future.

After considering the subject matter from this angle, the question naturally confronts us: Can the quality of protein, whatever it may be, good or bad, be improved? This is a problem before the present day flour mill chemist.

There have been flour improvers of many different kinds on the market; among these we find oxygen used in

different ways, and applied to the flour through different reagents. This element in the form of a gas seems to have the best advantage to date. And is along with inorganic salts, having some success in the East for a large baking firm.

The inorganic salts such as ammonium chloride and calcium chloride has been shown by Swanson (*6) to accelerate protein cleavage.

While other salts, as dihydrogen phosphate and others have a retarding action on protein cleavage. Just what the cleaved products formed are, has not been definitely determined. But up to a certain per cent of development it is an improving one on the baking quality. This cleaved product is no doubt formed by hydrolysis.

In applying any improver, and in the case of oxygen, it must be applied through an oxidizing agent that will not leave a residue, and especially a poisonous one. So in starting an investigation on oxygen I have used hydrogen peroxide with good success.

Swanson has found that if the amino compounds are increased to a certain point the baking quality is much improved, and beyond this point the quality decreases. While I have determined the amino compounds by Sorenson's method, and find a slight increase, I have not enough data to give confirming reports.

However there is such a decided improvement by using the correct percentage of the reagent, that another explanation is also fitting. By using results obtained on treated flour,

*NOTE. 1-Jour. of Ind. & Eng. Chem. Vol. 8, No. 2-139.

2-Studies on wheat protein, Comp. rend. 10, (1911) 170-206.

3-Min. Exp. Sta. Bull. 54 (1897)

4-Ztsche. Unter. Nahr. Geniess, 13, (1907) 67-74

5-Compt. rend. Acad. Sci. 156, (1913) 723-725

6-Jour. Am. Chem. Soc. May, 1916:

such as a reduction in acidity, increased loaf volume, and a shorter fermentation period, would lead one to believe that there are constituents in the flour which have a retarding action on the flour during the process of fermentation. This may be confirmed by Mathews (Physiological Chem.) who states that proteolytic enzymes act only in certain medium, and are retarded under certain conditions as in case of proteases where such enzymes do not start working until after autolysis has begun. And before autolysis this activity is retarded either by antibodies, or that the synthetic power of the cell is too great for proper development.

Mathews also states that by oxidizing the amino compounds with hydrogen peroxide a ketonic acid and ammonia (NH₃) is formed. The ketonic acid later being oxidized to the aldehyde. (Acetic aldehyde in this case). This may explain the shorter fermentation period.

C. J. PATTERSON.

Gliadin

PART I

The first part of this paper is a study of the various methods for the determination of gliadin, with the idea of selecting or modifying one method which the writer has found to give the best results. This method if found further satisfactory by the members could then be adopted by the Association.

Before taking up the determination itself it may be well to consider briefly the proteins and the properties of gliadin. The proteins are the most important constituents of the wheat kernel. The solutions of all proteins are optically active and laevo-rotatory. The proteins are colloids, and their varying solubilities are probably based on this property. Most of them are white, amorphous powders without definite melting points. On heating, they carbonize, with the evolution of gases. Many proteins readily change

into other substances, and the distinctions between the different varieties are not always well defined. High grade flours contain five protein substances:

1. Gluten proteins—
 - (a) Gliadin.
 - (b) Glutenin.
2. Non-gluten proteins—
 - (a) An albumen—Leucosin.
 - (b) A globulin—Edestin.
 - (c) A proteose.

Proteins contain only five elements, and do not differ much from one another in composition, as the following table indicates:

Carbon	50-55%
Hydrogen	6.5-7.3%
Nitrogen	15-17.6%
Oxygen	20-25%
Sulphur	5-2%

Gliadin is important because it is one of the factors affecting the baking value of a flour, particularly the expansion of the loaf. The amount of gliadin present is closely related to the size of the loaf. Flours of high gliadin content in most cases produce large sized loaves. The gliadin content is also of value in comparing the composition of different varieties of wheat.

Gliadin is the substance which binds together the flour to form dough and enables the mass to expand by retaining the gas generated by the yeast. According to Mathewson (*Jour. Amer. Chem. Soc.* 30 (1908) 74-81), it is soluble in Methyl, Ethyl, Propyl, Amyl, and Benzyl alcohols; Phenyl and Acetic acids; and dilute mineral acids and alkalies. It can be readily extracted from flour with a 70% (by volume) solution of ethyl alcohol. The chemical composition according to Chittendon and Smith (*Jour. Physiol.* 11 (1890) 410-434) is as follows:

Carbon	52.87%
Hydrogen	6.99
Nitrogen	15.86
Sulphur	1.17
Oxygen	23.11

These results are the average of eight determinations.

At present there are two distinct different methods for the determination of gliadin—the Kjeldahl method and the Polariscope method. Upon reviewing some of the literature on gliadin one finds that in the first method from the point where the digestion takes place with H_2SO_4 and K_2SO_4 that all chemists proceed about alike—that is, determine the nitrogen in the usual manner. However, up to that point different chemists handle the determination in

different ways. The main variations consist in:

- (1) Strength of ethyl alcohol for extraction.
- (2) Proportion of flour to solvent.
- (3) Length of time for extraction.
- (4) Temperature for same.

Minor variations consist in using 50 c. c. or 100 c. c. aliquots of the filtrate, in leaving the alcohol or evaporating previous to digesting, and in either disregarding or correcting for the amid nitrogen present.

The following is a synopsis of five different methods cited for comparison:

Method As	Flour	Alcohol	Strength	Length of Extraction	Temp.	Remarks
1 Given in Bur. of Chem. Bull's No. 122 and No. 152	4 gms.	200 c. c.	0.90 Sp. Gr. Approx. 65%	Shake occasionally during 3 hrs. Let stand 12 hrs.	Room	Pipette 100 c. c. of filtrate. Evaporate off alcohol. Determine Nitrogen.
2 Proposed by A. O. A. C. 1915	8 gms.	200 c. c.	70% By Volume	Shake occasionally during 2 or 3 hrs. Let stand over night.	Room	Pipette 50 c. c. Add 100 c. c. H_2O . Determine Nitrogen.
3 Given in Kansas Exp. Stat. Bull's No. 177 and No. 202	4 gms.	70% 100 c. c.	By Volume	Shake every half hour for 4 hrs. Allow to stand 20 hrs.	Room	Pipette 50 c. c. Evaporate off alcohol. Determine Nitrogen.
4 Suggested by C. H. Bailey	4 gms.	200 c. c.	.9343 Sp. Gr. 50% By Volume	Shake every 15 min- utes for 3 hrs.	83°C.	Pipette 100 c. c. Determine Nitrogen.
5 Employed in Agric. Chem. U. of Minn.	4 gms.	200 c. c.	.8892 Sp. Gr. 70% By Volume	Shake at intervals during 4 hrs. Allow to stand 16 hrs.	Room	Pipette 100 c. c. Evaporate off alcohol. Determine Nitrogen. Deduct Amids.

Upon examining some of the work which has been previously done on the extraction of gliadin from flour, we find, that in regard to the varying strengths of alcohol used, that it seems generally agreed that the maximum solubility is reached with 70% volume of alcohol. As the strength is

either increased or decreased from 70%, there is a marked decrease in the amount of gliadin nitrogen extracted.

As to the proportion of flour to solvent, it was found that relatively large amounts of solvent should be used with small amounts of flour.

Chamberlain (*Jour. Amer. Chem. Soc.* 28 (1906)) recommends that not over two grams of flour be used to 100 c. c. of 70% alcohol. If the extract is to be polarized, the error in the reading will naturally be greater with a concentrated solution than with a dilute one on account of the darker color.

As to the influence of the length of time for extraction upon the yield of alcohol-soluble nitrogen—we find that it seems generally agreed that all of the gliadin is extracted at the end of twenty-four hours. If the time is lengthened, there is a possibility that any slight increase in the amount extracted is due to evaporation, or to some substance other than gliadin.

As to the influence of temperature on the extraction, it was found that the use of hot alcohol gave too high results, although the time of extraction was able to be reduced. As a minor objection, it is evident that hot extractions can not be carried out as readily and conveniently as those at room temperature.

Gliadin, as previously mentioned, is laevo-rotatory, the degree varying with the solvent and the strength used. Snyder's polariscope method (*Jour. Amer. Chem. Soc.* 26 (1904) 263-266) is objected to by many workers on account of their inability to secure filtrates clear enough to polarize. Some have overcome this difficulty by filtering through double filter papers, or through animal charcoal, or by decreasing the shaking during extraction. But these various means have been found to produce a lack of agreement between duplicate determinations. When clear filtrates have been able to be obtained there is still another objection by many, and that is, that dissolved sugars and other non-protein material affect the readings, so that corrections for their presence must be made. And finally the temperature at which the readings are taken seems to affect the degree of rotation. The writer has tried the method, and in experiencing cloudily

filtrates was later able to overcome them by using a Gooch crucible with a layer of alcohol washed asbestos as filter. However, there was a lack of agreement between duplicate determinations. On one sample using 70% alcohol the readings on different solutions ranged from 78.5 to 85.8. It seemed that this variation was partly due to temperature changes and non-protein material.

Now, if gliadin determinations are to have any value in determining the quality of different grades of flour and of flour milled from different varieties of wheat, we must all follow the same method strictly. In other words, we must use a definite strength of alcohol, a definite proportion of flour to solvent, a definite length of time for extraction, and a definite temperature for same. After once obtaining the alcoholic filtrate, the question is whether to follow the Polariscope method or determine the nitrogen according to the Kjeldahl method. The time required to polarize a portion of the filtrate is shorter than to complete the determination of nitrogen in the usual manner, but the method is not nearly as accurate. Then, too, with certain flours the method has not been found applicable, on account of not being able to get filtrates clear enough to polarize. Furthermore, not very many flour mill laboratories can boast of a good Polariscope, such as a "Schmidt and Haensch," or "J. and J. Fric," and so the Polariscope method with many analysts is out of the question.

CONCLUSIONS

The writer has found the following method to give satisfactory results. It is essentially the same as number 5 of those cited previously. Some changes have been made and suggestions as to the handling of the determination have been added.

The method in detail: Extract 4 grams of flour, or finely divided wheat with 200 c. c. of 70% ethyl alcohol by

volume (Sp. Gr. .8892 at 15°C) for 24 hours, shaking at frequent intervals during the first 4 hours. The use of bottles with ground glass stoppers, or else ordinary pint whiskey flasks with rubber stoppers will prevent evaporation during the extraction. The latter have an advantage in that they may be laid flat side down, thereby allowing the solvent to act on a larger surface. Filter through an 8 inch filter paper, returning filtrate until clear. Pipette 100 c. c. of the filtrate into a 500 c. c. Kjeldahl flask and add five drops of conc. H_2SO_4 . Connect the flask to a condenser and distill off the alcohol.

It is a very good idea at this point to evaporate off as much of the alcohol as possible, in order to prevent subsequent frothing. Allow the contents of the flask to cool. Then add approximately 10 grams of K_2SO_4 with a small dipper, 12 c. c. of conc. H_2SO_4 from a burette, and a pinch of CuSO_4 from the end of a spatula. Continue the digestion until the liquid becomes clear or pale straw color. Cool, dilute with 250 c. c. of distilled water, add a pinch of powdered zinc to prevent bumping, render slightly alkaline with 50% NaOH , using phenolphthalein as an indicator. Distill into water containing 10 c. c. of N-10 H_2SO_4 . Titrate against N-10 H_2SO_4 using Sodium—Alizarin—Sulfonate as an indicator. Deduct the amid nitrogen from the alcohol-soluble nitrogen, and express the difference as gliadin, using the factor $N \times 5.7$. Run a blank on all the reagents used to determine the correction to apply.

PART II.

The second part of this paper is a study of the electrolysis of an alcoholic solution of gliadin. This work was done at the University of Minnesota some time ago. Ben-Hur Kepner in his thesis, "A Chemical Study of Wheat," was the first to notice that when two electrodes were put into an alcoholic solution of gliadin that the solution conducted electricity. The

conductivity of such a solution is for considerable importance, as it would tend to prove that gliadin dissociates on going into solution.

The experiments reported in the following pages were all made on the same flour. Extractions were first made using 10 gm. portions of flour with 200 c. c. of 70% neutral alcohol. 100 c. c. of the extracted gliadin solution was placed in a Pt. dish cathods, having a Pt. spiral anode suspended in it, and a 5 cell storage battery connected to the electrodes. Precipitation did not take place for some time, not until a certain amount of alcohol had changed over into acid. The gliadin was then deposited on the cathode dish as a white gelatine mass. The current was allowed to run several hours or until it seemed there was no further precipitation. In order to determine whether or not the precipitation was complete, the contents of the dish were thrown onto a filter and the filtrate again electrolyzed. No further deposition occurred showing that all the gliadin had been thrown out. The conductivity of the solution was not due to impurities. To prove this some of the alcohol was purified over potassium hydroxide and this solution also conducted a current.

Another fresh gliadin solution was electrolyzed, but this time a few drops of sulphuric acid were added. Upon this addition the precipitation took place immediately. A few drops of dilute hydrochloric and acetic acids produced the same effect in fresh solutions. In all cases, as the current was passed through, the action gradually increased. As it became more vigorous there was frothing, the dish became warm, and a strong choking odor of acetaldehyde was given off.

The slimy, white, gelatinous form of gliadin which was precipitated turned brown on exposure to the air, apparently oxidized. It was readily soluble in 36% acetic acid, on gentle warming. Upon setting aside in a crystallizing dish, feathery brown cry-

stals appeared on standing. It was likewise soluble in hydrochloric acid, and, on the addition of a few drops of chloroplatinic acid to this acid solution similar fine crystals appeared.

Yet this deposited substance was different in more than one way from the chemically pure gliadin prepared by the method of Osborne and Voorhees. (*Amer. Chem. Jour.* 15 (1893) 392-471). This C. P. material was readily soluble in 70% ethyl alcohol, but the electrolytic substance was not soluble to the slightest extent. Also, the prepared gliadin was a fine white powder, while the electrolytic substance was a gelatinous mass. On the other hand, the amount of nitrogen was determined on two samples of the gelatinous mass and the percentage found to be 16.42 and 16.65. This is about the amount of total nitrogen in the prepared gliadin. As mentioned before, the average of eight nitrogen determinations on gliadin, according to Chittendon and Smith gave 15.86%. Kepner in his work found 17.86%. This tends to prove that chemically the two substances are the same.

The gliadin extract offers quite a resistance to the passage of a current. For instance, in electrolyzing a fresh extract using a few drops of HCl in order to cause the current to conduct at once, the action became vigorous, with a strong odor and ammeter reading five amperes. As the volume of the solution decreased, fresh water was added. At each addition the current reading dropped appreciably depending on the amount added, but gradually crept up again.

It was thought possible that during the electrolysis the formation of certain amino acids might prevent entire precipitation of the substance from the extract. With this in mind, a fresh solution was electrolyzed in a glass beaker, using a cylindrical gauze cathode and spiral anode. The anode was separated from the cathode by an unglazed porcelain Pasteur filter tube.

Hydrogen was evolved at the cathode, and the gliadin instead of being precipitated as a gelatinous film was thrown down in a colloidal form. The yield, however, was the same as with using the dish cathode, without the Pasteur filter.

Later a series of extractions were made using twice the amount of flour—or 20 gms. per 200 c. c. of 70% alcohol. For electrolyzing stronger currents were used—about 25 volts, and yields of gliadin were approximately twice as large as previously. As before, as the current was passed through, the action became more vigorous. As it did so, the dish became warm, there was frothing, and a choking acetaldehyde odor was given off. The amperage increased from .2 to 5 amps. if resistance was not thrown into the circuit. Also, if a five ampere current was allowed to flow through, the contents of the dish would come to a boil, a thermometer suspended in the solution reading 80°C. The effect of this high temperature was to decrease the yield of the precipitate. The writer hopes in the future to further study the electrolysis of an alcoholic solution of gliadin.

CONCLUSIONS

1. Gliadin in a 70% alcoholic solution increased the conductivity of the alcohol.
2. In the electrolysis of such a solution, acetaldehyde and acetic acid are formed, undoubtedly from the oxidation of the alcohol.
3. Electrolysis of a 70% alcoholic solution of gliadin results in the precipitation of a gliadin compound with many characteristics of gliadin itself.
4. From above experiments, the electrolysis of such a solution would appear to offer a new means of determining the quantity of gliadin in flour.

LESLIE R. OLSEN.

Ash Determinations

In view of the fact that there has been much criticism of the accuracy of the ash test as made by different chemists and by different methods, it was thought fitting to carry on an investigation to find to what extent variations do occur in the ash content of a flour when the same samples is tested in different laboratories and by different analysts.

Therefore, a sample of patent and one of clear flour was put up in cloth bags and mailed to the following members of this Association: Messrs B. E. Kepner, C. F. Buck, C. R. Southwell, Ralph Potts, A. R. Sasse, M. E. Shultz, Frank Ackers, Gordon Auld, and A. H. Porter.

A sample of straight flour was also sent to the following commercial laboratories: A. W. Estabrook, French-Pancoast Laboratories, Fort Worth Laboratories, Oklahoma Laboratories,

and the Operative Millers Laboratory.

To find out if a knowledge of the source of the flour might influence the result, a sample of straight flour, with no marks of identification, was also sent to Prof. L. A. Fitz, of the Kansas State Agricultural College, The Howard Laboratories, and the Columbus Laboratories.

A letter accompanies each sample requesting that the analyst state whether the official or calcium acetate method was used, that the determination be made on the dried and as received sample, how much flour was used in the test, the kind of crucible used, porcelain or platinum, whether the ashing was done in a gas or electric muffle furnace, and the time and temperature of ashing.

The following results were received from the patent and clear samples:

	Meth.	Ash Patent		Ash Clear		Moist.	Amount	Cruc.	Furn.	Temp.	Time
		Before	After	Before	After						
	Dry	Dry	Dry	Dry		11.72 Pat.					
B. H. Kepner.....	Off.	.40	.44	.655	.74	11.32 C.	2 Grs.	Plat.	Elec.	750°F.	3½ hr.
B. H. Kepner.....	Cal.										
	Acet.		.42		.72		5 Grs.	Plat.	Elec.	900°C.	3 hr.
C. F. Buck.....	Off.	.405	.46	.665	.75		5 Grs.	Porc.	Elec.	Dull red	4 hr.
C. Southwell	Off.	.424	.452	.670	.730	11.07 Pat.		Porc.		525°C.	5 hr.
Ralph Potts.....	Off.	.404	.450	.641	.743	11.74 C.	5 Grs.	Porc.	Elec.	Dull red	14 hr.
A. R. Sasse.....	Off.	.402	.459	.650	.741	12.44 Pat.	5 Grs.	Porc.	Elec.	Low red	5 hr.
A. R. Sasse.....	Off.	.406	.464	.650	.738	"	3 Grs.	Porc.	Elec.	Low red	Over night
A. R. Sasse.....	Off.	.403	.461	.653	.742	"	5 Grs.	Porc.	Gas		5 hr.
Gordon Auld	Off.	.402	.452	.653	.742			Plat.	Elec.	Dull red	6 hr.
A. H. Porter.....		.408	.460	.665	.747	12.6 Pat.	1 Gr.	Plat.	Elec.	Dull red	2¼ hr.
M. E. Schulz ....		.41	.45	.65	.72	12.2 C.	2 Grs.	Jap	Elec.	1200°F.	5 hr.
Frank Ackers.....	Off.	.415	.44	.67	.72	9.25 Pat.		Porc.		Below	
						9.67 C.	3 Grs.	Porc.	Elec.	Dull red	5-6 hr.
W. A. Goldtrap	Off.	.413	.464	.663	.732	10.2 Pat.				red	
						10.83 C.	5 Grs.	Porc.	Elec.	Dull red	Over night

The maximum result on the patent sample was .424 per cent before drying; .46 per cent after drying. The minimum .40 per cent before drying, .42 per cent after drying. An extreme

variation of only .02 per cent before drying, and of .04 per cent after drying.

The following results were received from the sample of straight flour:

	Samp.	Meth.	Ash		Moist.	Amt.	Time	Cruc.	Furn.	Temp.
			Before	After						
A. W. Estabrook	Str.	Off.	.47	.52		4-6 Grs.	6 Hrs.	Porc.	Gas	Slight red
R. M. French	Str.	Off.	.500	.536		5. Grs.	60-75 Min.	Plat.	Gas & Elec.	600°C. 1000°C.
F. B. Porter	Str.	Off.	.481	.522	9.94			Porc.	Gas	1100°F.
F. B. Porter	Str.	Cal.	.476	.528	9.94			Plat.	Gas	1775°F.
H. G. Wahlin	Str.	Acet. Off.	.50	.563		5 Grs.	5 Hrs.	Fused Silica	Elec.	600°F.
J. C. Somers	Str.	Cal.	.48	.541	11.34	2 Grs.		Porc.	Elec.	600°F.
Prof. L. A. Fitz	Str.	Acet. Cal.	.55	.618	11.01	5 Grs.	3 Hrs.	Porc.	Elec.	800°F.
Howard Labr.	Str.	Acet. Off.	.49	.552	11.1	5 Grs.		Silica	Elec.	Red heat
Columbus Labr.	Str.	Off.	.50	.54	8.1	5 Grs.		Porc.	Gas	Dull red

In this table I wish to call attention to the results of Prof. L. A. Fitz, which are decidedly out of line. He used the calcium acetate method in making his determination.

The maximum result was .50 per cent before drying; after drying, .56 per cent. The minimum result, .47 per cent before drying, .52 per cent after drying. An extreme variation of only .03 per cent before drying and .04 per cent after drying. Drying seems to increase the maximum error.

I would also like to call attention to a series of tests carried out by Mr. H. E. Weaver at a previous time.

Laboratory	% Ash	A	B	C	D	E
A. W. Estabrook, Kansas City, Mo.		.38	.38	.39	.43	.38
French-Pancoast, New York City, N. Y.		.364	.410	.402	No report	.390
Larabee Flour Mills Corporation		.380	.380	.39	.43	3.90
3 Chemist—Five samples.						
Extreme variation .03.						
Sample sent out in 2 lb. sample sacks.						

Laboratories	% Ash	
Larabee Flour Mills Corporation	.378	
A. W. Estabrook, Kansas City, Mo.	.380	
French-Pancoast, New York City, N. Y.	.386	6 Chemist—One sample.
Kansas State Agricultural College, Manhattan, Kansas	.394	Extreme variation .022.
Oklahoma Laboratories, Oklahoma City, Oklahoma	.395	Samples sent out in sample envelopes.
Operative Millers Labr., Chicago, Ills.	.400	
Laboratory	% Ash	
Larabee Flour Mills Corporation, Hutchinson, Kansas	.390	
Larabee Flour Mills Corporation, Wellington, Kansas	.380	4 Chemist—1 sample.
Kansas State Agricultural College, Manhattan, Kansas	.376	Extreme variation .014.
A. W. Estabrook, Kansas City, Mo.	.380	Sample envelopes.

In view of the close agreement of the above results obtained in different laboratories and by different analysts, it is desired to call attention to an article appearing in the *Journal of Industrial and Engineering Chemistry*,

of October, 1916, on "Flour Milling Problems," by Mr. Harry Snyder, Chemist, with the Russell-Miller Milling Company. Mr. Snyder is reviewing the results obtained in an investigation of ash determinations on flour

carried on by the Association of Official Agricultural Chemists, in which the maximum result obtained was 0.72, the minimum 0.663 per cent, and says: "Hence it would seem fair to say that in well controlled analytical work variations of .05 to .06 per cent in the ash content of a flour may occur between the results of different analysts. "These extremes were found respectively in the Chicago and St. Paul Laboratories of the U. S. Dept. of Agriculture. With less experienced analysts the difference undoubtedly would be even greater. Since we must allow at least 0.06 per cent tolerance in an ash test for uncontrollable analytical errors, serious difficulties may arise in the practical application of the results." We have found the extreme variations to be .03 per cent.

Some people are also of the opinion that a small loss in moisture will very materially effect the ash percentage in flour. In an article published in the *Bakers Weekly* for April 10, 1915, on "The Ash in Flour," by Mr. Emil Braun in which he states that "a freshly milled flour with a normal moisture content and 0.45 per cent ash, will when the moisture has gone down $1\frac{1}{2}$ per cent during such storage, show a larger per cent of ash or over 0.50 or 0.60 per cent." Now by a simple calculation any one can see that a loss of $1\frac{1}{2}$ per cent moisture will change the ash per cent only 0.006 per cent. To change the per cent 0.01 per cent requires a loss of 3 per cent moisture. While to change the per cent from 0.45 to 0.50, as Mr. Braun states is possible, would require a loss of 10 per cent in moisture; and to change the per cent to 0.60 would require a loss of 25 per cent. It is hard to think of a flour containing as a maximum only 13.5 per cent moisture losing 25 per cent moisture in storage. It is such statements as this, having

no foundation in fact, that we should ever be ready to call.

Just a word about the calcium acetate method. I do not like this method and to my knowledge it is not used to any great extent in commercial work. It is more difficult to handle and requires a longer time. The evaporation to dryness over a water bath is a slow process with such a gelatinous mass. If the drying process is hastened the semi-liquid is apt to spatter and of course, the use of a covered crucible is out of the question. The actual burning is shorter but the time lost is in the evaporation. The calcium oxide is very hygroscopic and two weighings are at least necessary, with the official method one weighing is enough. Variable results are obtained.

In conclusion, I might say that there is no reason why the ash determination cannot be checked in any laboratory by any chemist using the official method, within less than 0.03 per cent, provided certain precautions are observed. It is very essential that the sample be ashed at a low temperature not above a dull red heat. In case the sample to be tested fuses, due to an abnormal high increase in temperature, it is always well to repeat the determination. If only slight fusing takes place, however, all that is necessary is to treat the sample with nitric acid so that the reduced phosphates may be again oxidized. The apparent loss in ash is due to the fact that the phosphates are reduced to metaphosphates, but by adding nitric acid they are again oxidized to orthophosphates. There seems to be no necessity for distinguishing between a method in which an ordinary muffle is used and one where an electric muffle is used. No difference in results was noticed whether porcelain or platinum crucibles were used.

W. A. GOLDTRAP.

The Gasoline Color Value of Flour

Flour has two colors. One is natural color, the other is mechanical color.

The mechanical color is due to dirt, weed seed, etc., or any fine foreign substance. Its percentage in the flour depends upon the equipment of the mill, the skill of the miller and the purity of the stock from which that particular flour was made. A patent flour, being made from the cleanest and best stock, contains very little mechanical color. A low grade flour runs high in mechanical color, since it is impossible to clean well the stock which is reduced to this flour.

The natural color of flour varies from a creamy white to a light yellow. This is due to the fact that wheat varies in color from white to a light brown. The white flours come from soft wheat, while the yellow flours come from either yellow berry or hard wheat.

U. S. Bulletin No. 137 Bureau of Chemistry contains an article by A. L. Winton on the natural or gasoline color value of flour. In this article the yellow coloring matter is called "oil-soluble color," since it may be extracted by the same solvent as the coloring matter associated with the oil. This solvent is ordinary colorless gasoline. Winton's method for determining color value is as follows:

Place 20 grams of flour in a 200 cc

wide-mouth, glass-stoppered bottle and add 100 cc of colorless gasoline. Shake well for five minutes and let stand (with frequent shakings) for 16 hours. Filter clear and determine color of any convenient amount of the filtrate in a Schreiner or similar colorimeter. Use a 0.005% solution of potassium dichromate for comparison. This dichromate solution has a value of 1.0. The color value of the unknown solution is obtained by dividing the reading of the tube of standard solution by the reading of the tube of the unknown solution.

In the following experiments the color value of each sample was taken from at least four different positions on the colorimeter and a comparison made of the results. This was done to reduce the error as much as possible.

Table I. gives the color value of both bleached and unbleached patents, clears and low grades, taken from the same mill on seven different days. The unbleached samples were taken from just ahead of the bleacher and the bleached flours taken from just below the bleacher. All the samples were taken at the same time so that their total would represent a 100% flour.

TABLE I.

	PATENT				CLEAR				LOW GRADE		
	Bl.	Unbl.	% of Bl.		Bl.	Unbl.	% of Bl.		Bl.	Unbl.	% of Bl.
	1.00	1.32	24.3		.80	1.46	45.2		.92	1.40	34.3
	1.12	1.44	22.3		.92	1.28	29.0		1.14	1.48	22.9
	1.02	1.40	27.7		.80	1.32	38.0		1.06	1.50	29.4
	.92	1.20	23.4		.70	1.32	47.0		1.00	1.32	23.5
	.90	1.25	28.0		.70	1.25	44.2		.90	1.43	37.0
	.80	1.25	28.8		.76	1.25	34.8		.90	1.50	40.0
	1.08	1.35	20.0		1.10	1.50	26.7		1.00	1.60	37.5
Average....	.97	1.31	26.0		.82	1.34	39.8		.99	1.46	32.9
Maximum	1.12	1.44	28.8		1.10	1.50	47.0		1.14	1.60	40.0
Minimum	.80	1.20	20.0		.90	1.25	26.7		.90	1.32	20.6
Variation..	.32	.24	8.8		.20	.25	20.3		.24	.28	19.4

This table shows the average gasoline color of unbleached clear —1.34 and unbleached low grade —1.46. Therefore the stock from which patent flour is produced does not contain as much natural color as the low grade flour stock. This may be readily seen since the low grade stock contains many branny particles which particles contain much oil soluble color.

Bleaching removes a part of the natural or oil soluble color, but has no effect on the mechanical color. The gasoline color of the bleached patent is higher than that of the bleached clear and only slightly lower than that of the bleached low grade. This is very likely due to variations in the amount of the bleaching gas used on the various grades. The percentage of color removed by bleaching varies from 20% for one sample of patent to 47% for a sample of the

clear. The average percentage of bleach for patents was 26%, for clears 39.8%, and for low grades 32.9%. Therefore, the variation is rather broad.

In order to give some idea of the variation of samples from different localities, samples were collected from six different mills in the State of Kansas. Table II. gives a comparison of their color value, percentage of bleach and amount of chlorine gas used per bbl. for bleaching. Table III. gives a comparison of the gasoline color and pekar color of the same set of sample as used in Table II. In making the pekar test, equal portions of each set of samples (as bleached patents) were mixed for a standard. Then each sample of this set was compared against this standard. The standard patent was given a value of 100, standard clear 90, and standard low grade 80.

TABLE II.

SAMPLE	A	B	H	K	M	P	Avg.
Oz. of Cl. per bbl. of flour.....	.50	.90	.75	.50	.40	.50	
Gasoline color Patent Bl.....	.80	.90	.87	.83	.75	.90	
Gasoline color Patent Unbl.....	1.20	1.40	1.25	1.27	1.06	1.39	
Percentage of Bleach.....	33.33	35.70	30.40	34.65	28.58	34.60	33.73
Gasoline color Clear Bl.....	1.10	1.00	.83	.....	.72	1.00	
Gasoline color Clear Unbl.....	1.25	1.50	1.29	1.40	1.08	1.45	
Percentage of Bleach.....	16.80	33.33	35.66	.....	33.33	31.10	30.04
Gasoline color Lowgrade Bl.....	.....	1.10	.83	.....	.50	1.07	
Gasoline color Lowgrade Unbl.....	1.40	1.50	1.42	1.50	1.40	1.48	
Percentage of Bleach.....	.....	26.66	58.45	.....	64.30	27.70	44.52

TABLE III.

SAMPLE	COLOR	A	B	H	K	M	P
Patent, Bl.....	Gasoline.....	.80	.90	.87	.83	.75	.90
Patent, Bl.....	Pekar.....	98.	102.	100.	98.	101.	101.
Patent, Unbl.....	Gasoline.....	1.20	1.40	1.25	1.27	1.06	1.39
Patent, Unbl.....	Pekar.....	100.	100.	101.	97.	101.	101.
Clear, Bl.....	Gasoline.....	1.10	1.00	.83	.....	.72	1.00
Clear, Bl.....	Pekar.....	88.	90.	92.	.....	89.	91.
Clear, Unbl.....	Gasoline.....	1.25	1.50	1.29	1.40	1.08	1.45
Clear, Unbl.....	Pekar.....	87.	89.	91.	88.	92.	93.
Low Grade, Bl.....	Gasoline.....	.....	1.10	.83	.....	.50	1.07
Low Grade, Bl.....	Pekar.....	.....	78.	82.	.....	83.	77.
Low Grade, Unbl.....	Gasoline.....	1.40	1.50	1.42	1.50	1.40	1.48
Low Grade, Unbl.....	Pekar.....	79.	81.	82.	77.	81.	80.

Table II. bears out the fact that unbleached patents contain less natural color than unbleached clears or low grades. Also that the percentage of bleach varies widely and not in accordance with the amount of chlorine gas supposed to have been used.

Table III. shows that a flour low in gasoline color does not necessarily show a good color when slicked up and compared by the pekar test.

While these experiments are not

very extensive, yet I believe there is no doubt but that they show that the gasoline color value determination is of no value in determining the different grades of flour. However, I believe it to be of value to the chemist and miller in determining and regulating the percentage of bleach of flour. It is of value also in stating in definite terms the oil soluble color of a flour at that time.

C. F. BUCK.

The Fort Worth Laboratories

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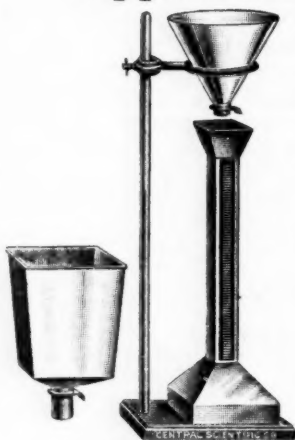
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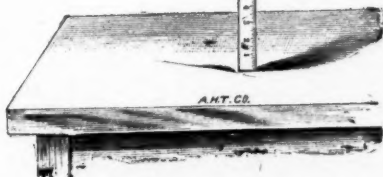
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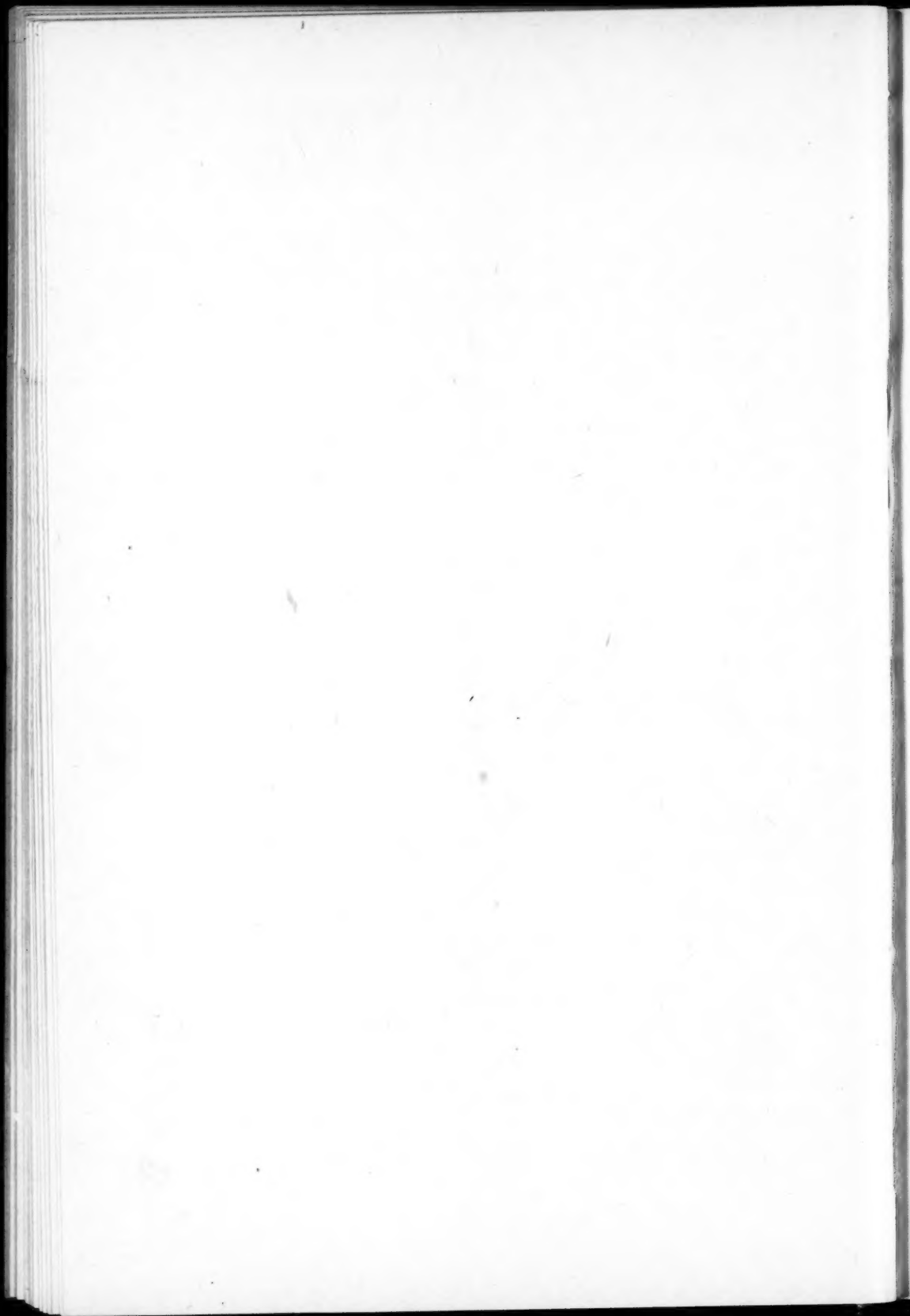
The economic advantages because of this feature of indestructibility were promptly recognized in industrial laboratories and in the laboratories for research and advanced work in educational institutions, but some hesitation was shown by large educational buyers as to the possible economy in the use of Pyrex ware for students' use because of the comparatively high price.

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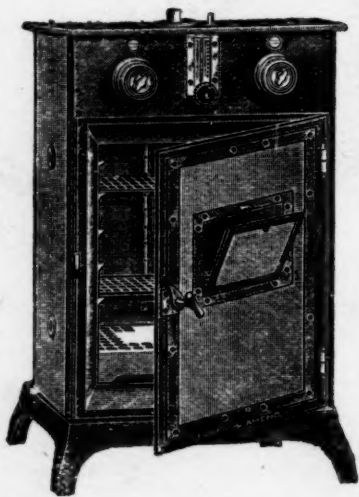


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